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The Director of Central Intelligence  
Washington, D.C. 20505

National Intelligence Council

NIC 05119/1-87  
18 December 1987

MEMORANDUM FOR THE RECORD

SUBJECT: EPC Meeting, 17 December on Space Commercialization

1. The Economic Policy Council (EPC) asked that the Working Group on Space Commercialization discuss further some of the proposals in the decision paper, providing a revised draft within about ten working days. Among the suggestions, the EPC asked NASA to draw up a list of potential customers so that it could estimate how much of the government-guaranteed funds might be expended for private launches. The paper proposes that the government "commit to a minimum \$140 million lease per year for five years" to assure a base for private launch development. OMB is concerned that there may be insufficient private demand, and that the government would actually have to expend some of the committed funds. I suggested they factor in foreign launch capability to judge how many launches might be lost to the French and, perhaps, others. OGI will provide a paper on this.

2. The National Security Council cited Department of Defense objections to the proposal which would reduce the monopoly held by INTELSAT, citing concerns regarding Low Intensity Conflict and Space Defense Initiative.

3. I discussed the outcome with [ ] and suggested he check on the Department of Defense problems. I also told him to expect the Directorate of Intelligence paper on foreign launch capability. [ ] will attend the Working Group sessions and report the results both to General Heinz and to me.

STAT

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Deane E. Hoffmann

Attachments:

- A. EPC Agenda and Paper
- B. National Journal Article

cc: D/OGI  
DC/OGI/TID  
~~DD/Planning & Policy/ICS~~  
AC/NIC  
NIO/S&T  
NIO/SP  
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THE WHITE HOUSE  
WASHINGTON

December 16, 1987

MEMORANDUM FOR THE ECONOMIC POLICY COUNCIL

FROM: EUGENE J. McALLISTER *EM*  
SUBJECT: Agenda and Paper for the December 17 Meeting

The agenda and paper for the December 17 meeting of the Economic Policy Council are attached. The meeting is scheduled for 11:00 a.m. in the Roosevelt Room.

The single agenda item will be a report from the Working Group on Space Commercialization. The Working Group has prepared for the Council's consideration a number of proposals for advancing commercial space efforts. A paper from the Working Group is attached.

Attachment

*456.6406*



ECONOMIC POLICY COUNCIL

December 17, 1987

11:00 a.m.

Roosevelt Room

AGENDA

1. Report from the Working Group on Space Commercialization

December 16, 1987

## COMMERCIAL SPACE INITIATIVE

A quarter of a century ago, U.S. technological leadership in landing a man on the moon and returning him safely to Earth pushed back the frontier of space, providing opportunities for new scientific discoveries and a myriad of commercial activities in Earth's orbits and potentially on the lunar surface as well.

The Administration remains committed to pushing back farther the frontier of space through continued exploration of the solar system. The technology development necessary for future missions will contribute importantly, as it has done in the past, to the U.S. commercial sector's competitiveness in space activities. However, vigorous commercialization of space -- as well as U.S. leadership in space overall -- ultimately will depend upon the United States' ability to assure reliable, low cost, and continual access to space and reduce the cost of space systems and infrastructure. These aims can be accomplished through traditional belief and reliance on the vitality and productivity of the U.S. private sector. In effect, the free enterprise system must be expanded to space.

The Working Group on Space Commercialization has developed an initiative for the Council's consideration. This initiative has three components:

- o Building a Solid Talent and Technology Base
- o Assuring a Highway to Space
- o Promoting a Strong Commercial Presence in Space

### I. BUILDING A SOLID TALENT AND TECHNOLOGY BASE

U.S. civil and commercial space leadership and competitiveness are highly dependent upon a sophisticated, evolutionary aerospace and space technology enterprise. This foundation will enable further exploration of the solar system and scientific discoveries and make routine commercial use of space practical.

In addition, while the national pool of talent drawn to these endeavors will inevitably depend upon market opportunities in the coming years, it is important that young people and their teachers have opportunities to become familiar with aerospace and

space-related careers and the link between excellence in these disciplines and basic math, science, and computer skills. In this regard, it is interesting to note that the scientists, engineers, and technicians necessary to operate the Space Station are in elementary school today.

Proposal 1:      The Administration will fund the Pathfinder technology development program beginning in FY 1989. (OMB currently has proposal under review in the budget process).

Project Pathfinder is a research and technology program that will enable a broad range of manned and/or unmanned missions beyond Earth's orbits. The Administration proposed initiating in the FY 1988 a predecessor to Pathfinder: the Civil Space Technology Initiative (CSTI). This initiative is intended to foster development of technologies critical to U.S. missions in the Earth's orbits.

In announcing Pathfinder, the Administration will stipulate a number of commercialization policies to apply to both the Pathfinder and CSTI programs:

- consistent with Administration policies and related statutes, federally funded contractors, universities and Federal labs will own the rights to any patents and technical data including copyrights resulting from this program;
- proposed technologies and patents available for licensing will be housed in a designated Pathfinder library; and
- when contracting for commercial development of technological products, NASA will specify its requirements in a manner that provides contractors with maximum flexibility to pursue innovative and creative approaches.

Project Pathfinder will be organized around four major focuses:

A.    Exploration Technology,  
including U.S. capability to develop:

- (a) planetary rover;
- (b) sample acquisition, analysis and preservation;
- (c) surface power; and
- (d) optical communications.

These technologies would be important to gathering data for robotic and manned missions to the moon, Mars, or other planets.

B. Operations Technology,  
including U.S. capacity to develop:

- (a) autonomous rendezvous and docking;
- (b) resources processing pilot plant;
- (c) in-space assembly and construction;
- (d) cryogenic fluid depot; and
- (e) space nuclear power.

These technologies would augment existing U.S. capabilities, while reducing the cost of space infrastructure and operations for Earth orbit missions or the robotic and manned exploration of the Solar System.

C. Humans-in-Space Technology,  
including:

- (a) extra-vehicular activity;
- (b) human performance; and
- (c) closed-loop life support.

These technologies would provide essential engineering systems to enable effective performance and good health during long-duration missions.

D. Transfer Vehicle Technology,  
including:

- (a) chemical transfer propulsion;
- (b) cargo vehicle propulsion;
- (c) high-energy aerobraking;
- (d) autonomous lander systems; and
- (e) fault-tolerant systems.

These technologies would provide critical logistics capability, while reducing the cost and risk for advanced transportation systems essential for a range of missions including Earth-orbiting science and the robotic and manned exploration of the Solar System.

## RESEARCH

Proposal 2:     The Administration will establish a new Federal-industry-university organization affiliated with the NASA Office of Commercial Space Programs to encourage a broader range of microgravity research opportunities for Federal, university, and commercial researchers. Federal agencies represented in the organization will include NASA, NSF, NIH, NBS, and other interested agencies.

This organization will have among its activities the following:

- a. Encouraging and facilitating Government leases of commercial vehicles and facilities, e.g. Spacehab and ISF, with microgravity environments;
- b. Developing a central mechanism to facilitate Federal, university, and commercial researchers' access to commercial R&D services, including payload design consulting and launch services;
- c. Facilitating through peer review access to limited research opportunities in the Shuttle and Space Station;
- d. Examining and recommending proposals for a Federal commercial launch voucher program, enabling Federal agencies to fund broader levels of microgravity research requiring a space launch.

#### EDUCATION

Proposal 3: NASA will expand its two week workshop program for high school science and math teachers to include junior high and elementary teachers. This will provide competitive opportunities for teachers to visit NASA field centers and selected aerospace industrial and university facilities.

The number of teachers annually participating in this program would increase from 200 to 1,000 at an annual cost of \$1.25 million.

Proposal 4: NASA will double the fellowship program for graduate and undergraduate students pursuing space science and engineering authorized in the FY 1988 budget National Space Grant College Act from the current 300 to 600 by 1990.

Doubling the number of fellowships would increase the cost of the program from \$5.2 million per year to \$10.8 million.

NOTE: NASA has not included these new education spending proposals in its FY 1989 budget request. If the Council recommends these new proposals, NASA requests that the funding be added to its budget -- rather than absorbed in its budget.

Proposal 5: NASA, NSF, and DoD will contribute materials and classroom experiments for coordination and distribution by the Department of Education to requesting schools for use in school development of "tech shop" programs and courses. NASA's Office of Commercial Space Programs will encourage corporate cost sharing of this program.

Proposal 6: As part of a possible Education Initiative, Federal agencies will encourage employees, including scientists, engineers, and technicians in aerospace and space related fields to take a sabbatical year to teach in any level of education in the United States under the Program.

## II. ASSURING A HIGHWAY TO SPACE

The interruption in the Shuttle system has created an opportunity for a private commercial launch industry to develop. The private sector was given a big boost in August 1986 when the President directed NASA to remove certain commercial and foreign payloads from the Shuttle manifest.

The commercial expendable launch vehicle industry now includes seven companies. The Department of Transportation estimates that the U.S. commercial launch sector has committed itself to non-recurring investments of more than \$400 million in facilities and equipment and more than \$1 billion in recurring expenditures to support commercial space transportation.

Long term competitiveness of the U.S. commercial launch industry will largely depend upon the U.S. sector's ability to reduce the costs associated with space launches and the nature of foreign launch competition, e.g. Europeans, Soviet Union, China, and Japan, much of which is currently subsidized. The President has directed USTR to begin international negotiations to ensure a level international playing field in commercial launch services.

The Working Group has identified several additional steps the Administration might take to ensure the development of the private U.S. commercial launch industry:

Proposal 7: All U.S. Government agencies will procure necessary ELV launch services directly from the private sector to the fullest extent feasible. (Implementing guidance will be contained in the forthcoming NSDD.)

Proposal 8: The Administration will consult with the commercial sector on the construction of commercial launch facilities separate from facilities owned by the DoD and NASA, and the



potential use of such facilities by the Federal Government (This proposal suggests the Federal Government may either provide subsidies for constructing commercial launch facilities and/or commit to purchase launch services at these facilities.)

Proposal 9: NASA and DoT will explore the possibility of providing a one time launch voucher that can be used to purchase private sector launches by requesting owners of secondary payloads that have a current agreement for a Shuttle launch. The voucher cannot be applied to payloads requiring the unique capabilities of the man-rated Shuttle.

Proposal 10: The Administration will also take administrative actions and offer statutory proposals to address the insurance concerns of the commercial launch industry.

- A. Third-party Liability: Consistent with Administration tort policy, the Administration will propose eliminating awards to third parties for punitive and pain and suffering damages resulting from commercial launch accidents.
- B. Government Property Damage Liability: The liability of commercial launch operators for damage to Government property arising from a launch accident shall be limited to the level of insurance required by DoT pursuant to the Commercial Space Launch Act. Above this level, the Government will waive its right to recover for damage to Government property. Below this level, the Government shall waive its right to recover for damage to Government property where such damage is caused by the willful misconduct of Government employees or Government contractors.

### III. PROMOTING A STRONG COMMERCIAL PRESENCE IN SPACE

Federal investment in space technology and ventures has provided over the years the foundation for several commercial space industries, including communication and remote sensing satellites, launch services, and materials processing. Although Government continues to be the primary source of funding for technology advances, increasing foreign competition and the costs of development and operation of space vehicles and facilities suggests that the key to U.S. leadership and competitiveness in space lays ultimately with the vitality and productivity of the

private sector. This means shifting from Federal "commercialization" of space through primarily technology spin-offs to Federal encouragement of commercial development and management of space systems and infrastructure.

In addition to policies regarding space commercialization enumerated in the proposed National Security Decision Directive on National Space Policy, the Working Group on Space Commercialization has identified the following proposals:

Proposal 11:     The Administration will announce a Federal commitment to the Industrial Space Facility (ISF) developed by the commercial sector. The Federal commitment will include the following:

- a.     The Federal Government will commit to a minimum \$140 million lease agreement per year for five years.
- b.     The Federal lease agreement will begin on the date that NASA has agreed to launch the facility, regardless of whether the launch occurs contingent upon the facility being otherwise ready for launch on that date.
- c.     Within thirty days NASA will develop and forward a plan for the use of ISF facility. Pursuant to this plan, NASA and ISF will establish a mutually agreed initial launch date.

NASA will make a "best effort" to service the industrial facility (three times per year) using the Shuttle system. NASA has already agreed to defer payments for these launches until the facility generates a revenue stream or two years after the initial launches.

Proposal 12:     The Administration will announce a Federal commitment to a commercially developed, owned, and managed pressurized Shuttle middeck module: Spacehab.

Spacehab modules are pressurized metal cylinders that fit in the Shuttle payload and connect to the crew compartment through the orbiter airlock. These modules take up approximately two tenths of the payload bay and increase the pressurized living and working space of orbiters by approximately 1,000 cubic feet. The area of the Shuttle where Spacehab fits is ideal for

microgravity research. In addition, the modules can serve as additional habitation for crew and specialists. The facility is intended to be ready in mid-1991.

The Federal commitment will include the following:

- a. A "best effort" to manifest the modules on the Shuttle up to three times per year, depending upon customer demand for Spacehab.
- b. A NASA commitment to lease part or all of the Spacehab facility primarily to work off its backlog of secondary R&D payloads.

An alternative to proposals 11 and 12 is to indicate a willingness to contract with private sector space facilities and solicit proposals.

Proposal 13: NASA will make expended Shuttle external tanks available to all feasible private sector endeavors, without necessarily recovering the cost of the tanks, over the next five years, subject to national security, international obligations, and public safety restrictions. NASA will provide any necessary technical or other assistance to these endeavors on a direct cost basis. If private sector demand is sufficient, NASA may auction the external tanks.

Proposal 14: The Government will foster a more competitive environment in satellite telecommunications by: (1) ending the FCC's "balanced loading" policy which now regulates the share of AT&T's international voice traffic that must be routed through INTELSAT, regardless of the cost of alternative routing; (2) introducing and advocating reforms within INTELSAT that will make its operations consistent with a competitive facilities marketplace; and (3) encouraging other nations to increase the competitive access to international facilities from within their territories.

Proposal 15: NASA will revise its Guidelines on commercialization of the Space Station to clarify and strengthen its commitment to private sector investment in the Space Station program. To underscore this commitment, NASA would announce, through a Statement of Interest in the Commerce Business Daily early in 1988, that it is prepared to purchase commercial goods and services to the

fullest extent feasible for development, operations, and logistics support of the Space Station, where such goods and services: (1) are not already being contracted for; and (2) are part of the approved program plan. Such goods and services would be privately developed and financed, and would fall into three categories:

- services, i.e. support for operations and logistics (includes items such as waste disposal, data and communications management, engineering support services);
- space transportation for assembly and servicing, which would include options for heavy-lift launch or man-rated ELV support; and
- equipment and components not already contracted for.

[NASA has proposed the following alternative formulation for Proposal 15: "NASA will, in consultation with OMB, review and as necessary revise its Statement on commercialization of the Space Station to re-emphasize its commitment to purchasing commercially available goods & services to the fullest extent feasible. NASA will take steps to assure that the Statement receives broad distribution, including publication in the Commerce Business Daily."]

NASA's current policy "welcomes and encourages participation" in the Space Station program by the private sector. The policy only states that NASA "will entertain proposals for commercial development and operations." This policy statement is not of sufficient strength that the private sector will make the necessary investments in development of space infrastructure.

Thus, it is important that there be specific and strong guidance to NASA that privatization of some aspects of the Space Station is desirable not only for the encouragement of space commercialization, but also to help maintain a reasonable schedule for development, deployment, and operations in the face of severe fiscal constraints on the Federal budget.

The private sector would finance the development, production, and operation of its elements, with

the Federal Government, through NASA, acting as the customer. Joint government-industry ventures could also be considered. In all cases, the commercial partner would own all rights to resulting technologies, with royalty-free use by the government for its own purposes.

Private sector proposals will be evaluated on the basis of criteria including amount of private sector investments and the degree of risk sharing.

Proposal 16: NASA will announce performance safety and schedule requirements, and provide an opportunity for a crew emergency return vehicle (CERV) to be designed, built, and operated by the commercial sector. (Note: A decision to build the CERV may be pending for some months yet.)

#### Further Work

The Working Group will be working over the coming months to assess the feasibility of a lunar base developed and managed by the private sector.

In addition, the forthcoming NSDD commissions a study to explore the means whereby the nation's private capital resources can be enlisted in order to support the space goals that lend substance and credibility to (continuing) United States space leadership.

## INDUSTRIAL SPACE FACILITY

The Administration will announce a Federal commitment for services such as the Industrial Space Facility (ISF) developed by the commercial sector. The Federal commitment will include the following:...[see Proposal 11]

### Background

The Industrial Space Facility (ISF) is a privately financed, constructed and operated space platform, proposed by Space Industries, Inc. and Westinghouse. The ISF will be launched and serviced by the shuttle and may be used as a: manufacturing facility, assembly platform, test bed, laboratory, power source or storage facility. The ISF module, when docked to the shuttle, provides a shirtsleeve work space to conduct manned research or maintenance activities. It supports automated research and processing payloads when orbiting in a free-flying mode. The ISF could be launched as early as 1991; it is currently manifested on the shuttle for 1992.

The ISF can serve as a: shuttle enhancement by extending the shuttle's on-orbit duration and providing additional power, a shirt-sleeve work space and storage space; space station pathfinder by offering a test facility for systems, user equipment, logistics and operating procedures and by extending shuttle on-orbit duration during space station build-up; defense research and operations facility by accomodating special purpose equipment and providing access to open space, short-term high-power surges and secure controlled integration and operations; material sciences laboratory by supporting either manned or automated experiments and allowing on-orbit reconfiguration and servicing.

The Space Industries Partnership has already raised \$30 million for design and development work. It plans to raise an additional \$200 million in equity investment and \$475 million in debt to deliver one fully functional ISF on orbit. The Space Industries Partnership has an agreement with NASA to provide 3 shuttle flights on a deferred payment basis.

## Analysis

Government-created risks represent barriers to attracting debt financing into commercial space ventures. In the case of ISF, private debt markets are unable to assume the risk of timely shuttle launches, overall shuttle performance and the commercial risk associated with insufficient user contracts. Consequently, necessary debt capital is unavailable unless the government directly or indirectly assumes responsibility for timely shuttle performance and for providing a long-term commitment to purchase services sufficient to secure commercial financing. The Space Industries Partnership will assume responsibility for timely delivery and on-orbit operations of the ISF and will assume cost overrun risks by providing basic on-orbit services at fixed rates.

## Pros

- o ISF represents a dramatic privatization initiative, involving \$250 million of private capital at risk to help build the nation's space infrastructure.
- o The proposed approach (a fixed-price government service contract) is an efficient way to stimulate private investment and innovation in space. It is a fiscally responsible way to help maintain space leadership.
- o The U.S. will have a permanent, man-tended, commercial space facility in orbit in 1992--put there with private capital--which can, among other things, actively support space station development activities.
- o Successful deployment of ISF will help break the current logjam in commercial space development and encourage other large-scale entrepreneurial space ventures.
- o It is expected that a competitive market will develop as the initial contract period helps establish the commercial viability of on-orbit services. [Note: the government service contract covers only a portion of the ISF to facilitate debt financing. The remainder must be sold to commercial customers if the Partnership is to break even. The venture

will be profitable when ISF facilities are expanded to support more customers.]

Cons

- o Neither NASA nor DoD has acknowledged a requirement for a facility like ISF, but they might have uses for such a facility if it were available.
- o A government service contract of this magnitude should be awarded competitively, even though doing so may constitute an expropriation of a privately financed development effort.
- o The U.S. government cannot establish firm launch dates beyond 1990 at this time even for its own flights.
- o Shuttle performance requirements for the ISF may require additional investments for shuttle improvements.



## SPACE REPORT

# Payloads for Profit

American rocket makers are getting set to cash in on space launches now that the government has stepped aside, but foreign competitors are also jockeying for contracts.

BY CAROL MATLACK

Nature abhors a vacuum, and so does private enterprise. When the National Aeronautics and Space Administration (NASA) got out of the commercial space-launch business and bumped most civilian customers from its space shuttle after the *Challenger* disaster last year, the private sector rushed in.

Major U.S. rocket manufacturers cranked up production lines, and by this fall they had signed contracts for 12 satellite launches, starting in mid-1989, with dozens of other deals under negotiations. Smaller rocket companies have moved to corner the market on lighter-weight satellite launches and suborbital flights.

Is this burst of energy a sign that the American adventure in space is entering a new era—one in which the big investments will be made, and the big rewards reaped, by business? Many Reagan Administration officials hope so: Increased private-sector activity has been an explicit goal of U.S. space policy since President Reagan took office.

"The success in the ELV [expendable launch vehicle, or rocket] industry is the proof of what we're talking about," said Gregg R. Fawkes, director of commercial space programs at the Commerce Department and head of an interagency panel that is reviewing U.S. commercial space policy.

Fawkes said that the private launch industry took off as soon as "the government definitively got out of the way."

But despite the launch industry's striking turnaround, a sustained commercial presence in space is still far from assured, and for the time being, the government seems destined to remain a major player.

The fledgling private launch industry is already seeking government help on two pressing concerns: liability insurance costs and overseas competition. Even if those problems are solved, many analysts foresee hard times for the industry after the current backlog of satellite launches is cleared away.

Still more problematic are the prospects for space-based manufacturing—factories that could grow perfect crystals or produce pure new pharmaceuticals in zero-gravity conditions. While researchers say such technology is within reach and entrepreneurs say they are getting fresh encouragement from NASA, these

would-be manufacturers have a big problem. They need dependable, affordable transportation—but so far, all they have is the space shuttle, which has proven far less reliable, and far more costly, than anyone imagined. (See box, p. 3085.)

## WAIT-LISTED

For now, there is big money to be made in the launch business, and most of it is going to be made by three companies: McDonnell Douglas Corp., Martin Marietta Corp. and General Dynamics Corp. These firms, longtime contractors for NASA and the Air Force, already had heavy-duty rockets with proven track records that they could peddle to customers who were left stranded after the shuttle accident.

McDonnell Douglas got an extra boost early this year when it received an Air Force contract to build a new, medium-sized Delta 2 rocket—a vehicle well-suited for launching communications sat-

ellites. With its production lines already up and running for the Air Force, the company will be able to turn out extra rockets for the commercial market at relatively little cost, said Mark Oderman, managing partner of CSP Associates, a space consulting firm in Cambridge, Mass. McDonnell Douglas has already contracted for four satellite launches: two British broadcasting satellites, one for the Inter-



Commerce Department space program chief Gregg R. Fawkes  
When the government stepped aside, private industry jumped in.

Richard A. Bloom

national Maritime Satellite Organization and one for the Indian government.

Martin Marietta, which already was building Titan 4 and Titan 2 rockets under Air Force contracts, has signed up four private launches: two for the International Telecommunications Satellite Organization, one for a Japanese communications satellite and one for the British defense ministry.

And General Dynamics recently won contracts to launch three U.S. government weather satellites and a European telecommunications satellite aboard its workhorse Atlas-Centaur.

"We're quite pleased to be off to such a good start," said Roger A. Chamberlain, vice president for program management at Martin Marietta Commercial Titan Inc. "It's not a question if we're going to launch, it's when and how much."

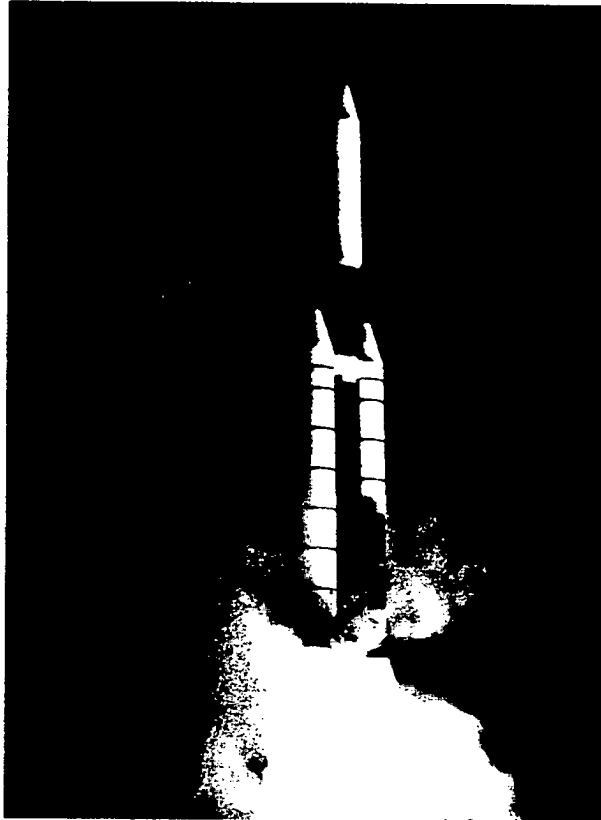
Until the *Challenger* accident, the U.S. private launch industry was moribund. A commercial space transportation office in the Transportation Department, established in 1984, was supposed to encourage development of such an industry. But NASA regarded private launches as "a threat" to the shuttle and imposed cumbersome regulations on firms seeking to test rockets for commercial use, said Courtney A. Stadd, who heads the Transportation office. More important, the space agency was heavily subsidizing the shuttle, keeping prices so low that private firms couldn't hope to compete, Stadd said. "They were vacuuming up the business," he said.

"Had the *Challenger* accident not occurred, they [commercial launch services] probably would have closed up shop," said Oderman of CSP. "It came at the 11th hour as far as the ELV manufacturers were concerned."

The realization that the shuttle would be grounded for at least two years, and the Administration's decision in August 1986 to reserve most future shuttle flights for defense and NASA missions, sent the space agency's former customers scurrying to find other transportation.

Some went to the French company Arianespace, which quickly booked up all its available space through 1989—and then suffered a series of technical problems that kept its rockets grounded for 16 months, until September of this year.

By mid-1987, Oderman said, satellite companies were so desperate that they



*In civilian garb: a rendition of a Titan rocket.*

Martin Marietta Corp.

were willing to "get any vehicle at any price."

Private launch companies also began getting business from the government after the Administration decided that NASA should no longer maintain a fleet of rockets to launch satellites for other civilian agencies. Those agencies, such as the Commerce Department's National Oceanic and Atmospheric Administration, now must contract for private launch services.

### FLIGHT INSURANCE

But even in this seller's market, there are problems. One is the question of liability—who would pay the bill if, say, a giant rocket carrying a commercial satellite veered off course from Cape Canaveral and plowed into the nearby town of Cocoa Beach?

Even the giant rocket companies say that they cannot afford insurance to cover that scenario, and they are asking Congress for help. At a hearing before the House Science, Space and Technology Subcommittee on Space Science and Applications on Sept. 15, industry representatives urged the government to place a cap on their liability in case of a major accident in which outside parties were injured.

"Industry is not asking for a free ride and is prepared to accept larger than normal risk," John F. Yardley, president of

McDonnell Douglas Astronautics Co., said at the hearing. "However, if U.S. launch vehicle contractors are to compete effectively so that we can remain the world leader, the government will have to reaccept part of the risk." Industry officials note that the French government has agreed to indemnify Arianespace for any third-party claims exceeding \$70 million.

U.S. launch companies are signing contracts on the assumption that Congress will solve the insurance problem before the first scheduled U.S. commercial flights in 1989, said Martin Marietta's Chamberlain. "We can't afford to wait," he said.

But the Administration is likely to resist legislation that would provide "outright indemnification" to the industry, Stadd said. "I believe there is sufficient capacity and sufficient coverage" from private sources, the Transportation official added. "It's no different from what you find in aviation and other transportation sectors. We don't want to provide subsidies."

### RED RIDERS

U.S. launch companies also face stiff competition from abroad—and not just from Arianespace, which had garnered half the worldwide launch business even when the shuttle was offering cut-rate trips into orbit for as little as \$25 million.

Now China and the Soviet Union are getting into the act, and Japan may not be far behind. The Soviets are aggressively marketing their Proton rocket, and the Chinese are pushing a rocket called the Long March. Both charge roughly half the going rate for U.S. commercial launches, which range from about \$40 million to more than \$100 million, depending on the size and positioning of the satellite. What's more, "you can sign up for a Proton launch that'll be ready to send your satellite up in 12-18 months," sooner than the first scheduled U.S. commercial launch, said Sarah C. Carey, a Washington lawyer who has represented some satellite companies in talks with the Soviets.

And so, when the Soviets started a U.S. advertising blitz early this year—complete with advertisements touting Proton as "Your Fast Track to the Stars"—satellite companies pricked up their ears.

Eugene Murphy, vice president for communications at General Electric Co., told the House Science Committee that

# Waiting in Line for a Ticket into Space

When the National Aeronautics and Space Administration (NASA) hosted a meeting in Nashville, Tenn., this fall to discuss possible commercial uses of its planned space station, 141 companies sent representatives.

James T. Rose, the new NASA assistant administrator for commercial programs, was delighted.

"Ten years ago, you couldn't have gotten 15 companies to show up," he said. "I'm already concerned about not having enough space" to fit commercial users on the station.

But if these companies are eager to put their ingenuity to work in space, they also share a major problem: They have no way to get there. The space shuttle will not resume flying before next summer, at best, and the space station, even if construction proceeds on schedule, will not be ready until the mid-1990s. What's more, the station is principally intended for research and development, not full-scale manufacturing. And would-be manufacturers have yet to find an alternative to the pricey shuttle for hauling raw materials and finished products.

"The lack of an assured source of transportation to and from space is the greatest roadblock to space manufacturing," said John E. Naugle, a space consultant and former NASA official, in a recent paper on space commercialization. While most entrepreneurs can shop around for a freight carrier, no such choice exists for a space manufacturer, Naugle said, and "if a single shuttle malfunctions, as *Challenger* did, a space manufacturer will find himself without transportation for six months-two years."

"It all boils down to access," agreed L.J. (Bud) Evans, who formerly headed the NASA commercialization program and now heads an Arlington (Va.) space consulting firm. "I don't think you can make this business go without diverse ways of getting into space and coming back."

Still, Evans and others eyeing business opportunities in space say that they are encouraged by changes in NASA's commercial space office since Rose took over in October.

Rose lifted a moratorium on joint agreements with industry that was imposed after the January 1986 *Challenger* accident, a move that ensures federal money to nurture research and development projects that could lead to space-manufacturing breakthroughs.

NASA also has promised to draw up a price list for potential space shuttle customers and has increased the weight limit for shuttle cargos. Although most commercial projects have been barred from the shuttle, the space agency has allocated 28 per cent of its secondary cargo space for commercial users. One commercial project, an experiment by Minnesota Mining and Manufacturing Corp. to study the effect of weightlessness on organic solids, is scheduled to



James T. Rose, head of NASA's commercial programs  
*He's trying to give space entrepreneurs "the right kind of start."*

be flown on the next shuttle flight.

"We're probably looking at an 8-10-year time cycle" before any company would be ready to start full-scale manufacturing in space, Rose said. "We want to try to give these people the right kind of start."

While some companies want to make things in space, others are eager to sell facilities and services. The most ambitious proposal

so far has come from Space Industries Inc., a Houston firm that wants to build a free-flying space platform called the industrial space facility. The facility, which could be used for research projects or manufacturing, would not be permanently manned but would be visited periodically by the shuttle. NASA has had a long-standing agreement with the company to launch the facility aboard the shuttle and to defer billing the company for the launch until the facility has started to generate revenues—but so far, the agency has not set a launch date.

With NASA's proposed space station facing cost overruns and a slipped construction schedule, some advocates have suggested that the private station should be launched before NASA's is finished. But Rose said that most aspiring space manufacturers aren't ready for the facility yet and if it were launched early, the company would probably have to find a government agency to lease it.

Spacehab Inc. has the opposite problem. The Washington-based company wants to build a module that would piggyback onto the space shuttle, providing extra pressurized space for materials-processing experiments and other commercial projects. The company has plenty of customers eager to pay for a ride, said Spacehab president Richard K. Jacobson. But NASA officials have been leery about the project, warning that the extra weight could create safety problems, and have declined to set a launch date.

Meanwhile, some space experts caution that the commercial potential of space manufacturing may have been oversold. Naugle's paper points out that many companies pursuing research projects with NASA are more interested in "using this knowledge to improve manufacturing processes on the ground than to start manufacturing operations in space." And while advocates only a few years ago were estimating annual space-manufacturing revenues as high as \$200 billion by the turn of the century, the estimates have lately been pared to as low as \$2 billion.

But others see a rosier future. "There's an element of faith in all of this," said Gilbert W. Keyes, president of Boeing Commercial Space Development Co., a new subsidiary of Boeing Co. "By the turn of the century, we firmly believe there are going to be commercial opportunities.... It's vitally important to keep moving ahead."

the United States should "seriously investigate whether commercial satellite operations should be allowed to use the services of the Proton and the Long March vehicles." While acknowledging that there were "legitimate concerns of avoiding technology transfers" to Communist governments, Murphy said, "we believe that these concerns can be overcome and that U.S. satellites can be satisfactorily fitted and launched by those services without giving away any hard-won technological know-how." Not surprisingly, U.S. launch companies at the same hearing argued strenuously against the use of the Soviet rocket.

The State Department has blocked the Soviet effort by refusing to lift a longstanding ban on high-technology exports to the Soviet Union. The department this fall turned down a personal appeal from Roger B. Smith, chairman of General Motors Corp., whose subsidiary, Hughes Communications Inc., was interested in a Proton launch contract.

Arthur Dula, a Houston lawyer who has been a go-between in some U.S. companies' negotiations with the Soviets, said that the State Department's restrictions are ridiculous because "there isn't any secret technology" in the communications satellites that the companies seek to launch on Proton. "It's purely political," he said. "They're embarrassed that we have no capacity."

There is no such impediment to using the Chinese Long March. The United States relaxed restrictions on technology exports to China when relations thawed during the Nixon Administration, a State Department spokesman said. While no U.S. company has applied for a license to launch a payload aboard the Long March, the spokesman said, "at least three or four" firms have obtained preliminary clearance to exchange technical data with the Chinese, a prerequisite to obtaining a U.S. export license. A spokesman at the Chinese Embassy confirmed that "several U.S. companies" are negotiating for Long March launches but said that he could not name them.

Meanwhile, U.S. launch companies are looking anxiously over their shoulders at the Japanese, who are developing their own commercial launch capability and are expected to enter the market in the 1990s.

## IFFY BUSINESS

While McDonnell Douglas, Martin Marietta and General Dynamics are likely to dominate the communications satellite launch business, several smaller companies are trying to carve out other market niches. Most communications satellites weigh more than a ton and must be boosted into a high, geosynchronous orbit, where they keep pace with the Earth's rotation. That means building a big rocket, too daunting an assignment for small firms that lack the cushion of large defense contracts.

Instead, younger companies are taking aim at smaller payloads, such as military and scientific satellites that can be placed in lower orbits and even some suborbital flights in which a canister is lofted into space for only a few minutes' weightlessness.

Most potential customers are government agencies; for example, American Rocket Co. of Camarillo, Calif., recently won contracts for two experimental launches for the Defense Department's Strategic Defense Initiative Organization. But some are private customers that were bumped from the shuttle, said Jim Davidson, project manager for Space Services Inc. of Houston, a small launch company that is courting commercial business. Conatec Inc., a three-year-old firm in Lanham, Md., has negotiated two contracts with European customers for sub-orbital flights.

While bigger firms worry about liability and foreign competition, "our major obstacle is raising capital," and that problem has worsened since the stock market crash, said American Rocket Co. president George A. Koopman.

But one question looms over all the companies, large and small: whether there

is enough of a market to sustain a private launch industry after the current backlog is gone. In a study last year, the Congressional Budget Office (CBO) warned that government and industry officials have consistently overestimated demand for commercial launch services. Higher price tags on private launches (compared with subsidized shuttle launches) could dampen demand further, the CBO said.

Stadd dismissed the CBO's findings as the work of "armchair analysts" and said: "This is a dynamic industry. What stagnated the industry was the government monopoly."

Nevertheless, the communications satellite business—the bread and butter of the big launch companies—has fallen on hard times. There is a worldwide glut of satellite capacity, and the advent of fiber-optic cables has cut into satellite business. And many smaller launch companies are counting on the development of space-based manufacturing—still an iffy proposition—to help sustain them.

NASA's critics say that its bungling of the space shuttle program illustrates the folly of letting the government provide a service that could be provided by the private sector. "NASA tried to do everything they could to make sure the private ELV industry never got off the ground," said Milton Copulos, a space analyst at the Heritage Foundation. "We wound up with no alternative to the shuttle."

Some Administration officials argue that NASA should function primarily as a research and development agency and let private firms take over operations of proven technology. "We've made no secret that we believe NASA should minimize its operational role," Stadd said.

On the other hand, the first experiment with space privatization—turning over the Landsat remote-sensing satellite program to Eosat Corp.—has been widely judged a disaster. (See *NJ*, 7/25/87, p. 1903.)

Talk of privatizing the space shuttle, which surfaced for a time after the *Challenger* accident, has now all but disappeared. "Everybody who was dependent on [the] shuttle is looking for other ways to do things," Fawkes of the Commerce Department said. "But subsidized rides on the shuttle are essential" for some projects, he said. "They can't go anywhere else." □



Courtney A. Stadd of the Transportation Department  
NASA's subsidized shuttle was "vacuuming up the business."